IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Abhay S. Kant et al.	§	Group Art Unit: 2863
Serial No.: 10/720,817 Filed: November 24, 2003	§	Examiner: Lau, Tung S.
For: METHOD AND APPARATUS FOR DETECTING RUB IN A TURBOMACHINE	§	Atty. Docket: 133918-1/SWA GERD:0332

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

CERTIFICATE OF TRANSMISSION OR MAILING
37 C.F.R. 1.8

I hereby certify that this correspondence is being deposited with the U.S. Postal Service with sufficient postage as First Class Mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on the date below:

11-8-2006
Date

Tait R. Swanson

Sir:

DECLARATION OF JOSEPH ROBERT TOTH UNDER 37 C.F.R. § 1.131

I, Joseph Robert Toth, hereby declare as follows:

1. I am a co-inventor of record of the above-referenced application.

2. My residence address is set forth below, along with my signature.

3. We conceived the subject matter disclosed and claimed in the above-referenced application in the United States, a NAFTA country, or a WTO country at least prior to September 30, 2002. This conception is evidenced by slides 1, 2, 5, 9, and 14 of a PowerPoint presentation relating to "Modified Algorithms based on feed back received from review meeting on July 19, 2002," as indicated by slide 1. *See* Exhibit A. These slides generally illustrate and describe systems and methods for monitoring operational parameters of a turbomachine (e.g., a turbine generator) on-site via various sensors, identifying anomalies in data received from sensors, and detecting possible rub events. Slide 2 is labeled "High Differential Expansion along with High Vibration," and illustrates and describes monitoring bearing vibration, checking for abnormal amplitude or variation, and triggering an alarm if an anomaly is observed with the bearing vibration.

Slide 5 is labeled "High eccentricity following vibration excursion," and illustrates and describes monitoring or checking for abnormalities associated with vibration or eccentricity, and identifying a possible rub during shut down of a turbine generator (indicated by "TG" in the slide). Slide 9 is labeled "Sudden large shell temperature ramp," and illustrates and describes monitoring parameters, identifying an abnormal change in steam and shell metal temperature, identifying an abnormal change in vibration, and identifying a possible rub event in the turbine generator (i.e., steam turbine generator). Slide 14 is labeled "Rub Anomaly Flow Down," and illustrates and describes various techniques for monitoring and identifying abnormalities to identify a possible rub event. The PowerPoint presentation was prepared at least prior to September 30, 2002. A true and redacted copy of this PowerPoint presentation is attached hereto as Exhibit A.

4. We actually reduced to practice the subject matter disclosed and claimed in the above-referenced application in the United States, a NAFTA country, or a WTO country at least prior to September 30, 2002. This actual reduction to practice is also evidenced by the Excel graph labeled "Desk Top validation results (9/17/02)," which records successful completion and testing of a prototype of the method and system set forth and claimed in the referenced application at least prior to September 30, 2002. *See* Exhibit B. Specifically, the Excel graph represents data collected while monitoring the operation of a turbomachine, and indicates anomalies that correspond to possible rub events in the turbomachine. The Excel graph illustrates variation in speed relative to time and four different alarms indicative of a possible rub event. The Excel graph was prepared at least prior to September 30, 2002. A true and redacted copy of this Excel graph is attached hereto as Exhibit B.

5. This actual reduction to practice is further evidenced by the PowerPoint presentation relating to "Steam Turbine Remote Monitoring & Diagnostics Rub Detection CDE Application Design Review," which is dated December 18, 2002, and includes various data, graphs, diagrams, and information relating to conception and reduction to practice prior to September 30, 2002. *See* Exhibit C. Slide 3 is labeled "ST Rub CDE Design Review," and indicates that the Continuous Data Engine (CDE) is a real-time anomaly detection platform that resides on the On-Site Monitor (OSM) for Steam Turbines (ST). Slide 19 is labeled "Validation results for DT and OSM testing with real field data," and tabulates testing of a steam turbine remote monitoring and diagnostic

system on 7/9/2002, 6/26/2002, 6/13/2002, 5/8/2002, 7/13/2002, 6/8/2002, 6/24/2002, 5/31/2002, 11/9/2002, 9/17/2002, and 5/21/2002. Slide 20 is labeled "OSM Validation Results of CDE algorithms with 'Real Rub Event' Data Overview," and illustrates successful testing of the remote monitoring & diagnostic system to identify rub events in a steam turbine on 5/21/2002, 6/24/2002, and 7/9/2002. Slide 21 is labeled "OSM Validation of CDE algorithms with 'Real Rub Event' Data," and illustrates further successful testing of the remote monitoring & diagnostic system to identify rub events in a steam turbine on 6/8/2002 and 6/24/2002. Slide 39 is labeled "On-Site Data Flow," and illustrates an On-Site Monitor (OSM) Data Flow Diagram related to a design review on November 13, 2000. The diagram of slide 39 illustrates a web interface and a mail service for monitoring a turbine generator. Slide 69 is labeled "DT Validation of CDE with ... unit data, 270T489," and illustrates further successful testing of the remote monitoring & diagnostic system to identify rub events in a steam turbine on 5/31/2002 and 9/17/2002. A true and redacted copy of this PowerPoint presentation is attached hereto as Exhibit C.

6. I declare further that all statements made herein are of my own knowledge, are true and that all statements made on information and belief are believed to be true, and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. §1001, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

Dated: 11/2/06 By: Joseph R. Toth

Joseph Robert Toth

Declarant's Full Name: Joseph Robert Toth

Country of Citizenship: USA

Residence Address: 314 Morning Glory Trail, Powder Springs, GA 30127

EXHIBIT A – 1/5

Modified Algorithms based on feed back received from review meeting on July 19th 2002

Major modifications carried out in:

8.6.76 High Differential Expansion along with High Vibration	Sheet: 2
8.6.71 Rotor locks in and vibrates at its first critical	Sheet: 3
8.6.61 High eccentricity following vibration excursion.	Sheet: 4 & 5
8.6.73 High response to 1st critical	Sheet: 6 & 7

Minor or No Modifications in:

8.6.77 Sudden large shell temperature ramp	Sheet: 8 & 9
8.6.67 Different speed/vibration map for run up vs. coast down	Sheet: 10 & 11
8.6. 74 High response to 2nd critical	Sheet: 12
8.6.64 Unsteady or sporadic overall vibration with LP overall vibration affected with Load, back Pressure, Hood Temp	Sheet : 13

EXHIBIT A - 2/5

8.6.76 High Differential Expansion along with High Vibration

Priority HH

(This calculation shall be performed during Start-up and Shut down modes of the unit.)

1. Monitor alarm for 'Differential Expansion High' to raise an anomaly.
2. Monitor bearing vibration.
3. Calculate actual variation in vibration values.
4. If abnormal amplitude or abnormal variation is observed, and this is observed for 3 consecutive samples, then raise an anomaly.'High/ Abnormal VibrationOnBBXX'
5. If both these conditions are appearing, then raise an anomaly 'AbnormalVibWithAbnormalDiffExpansion'.

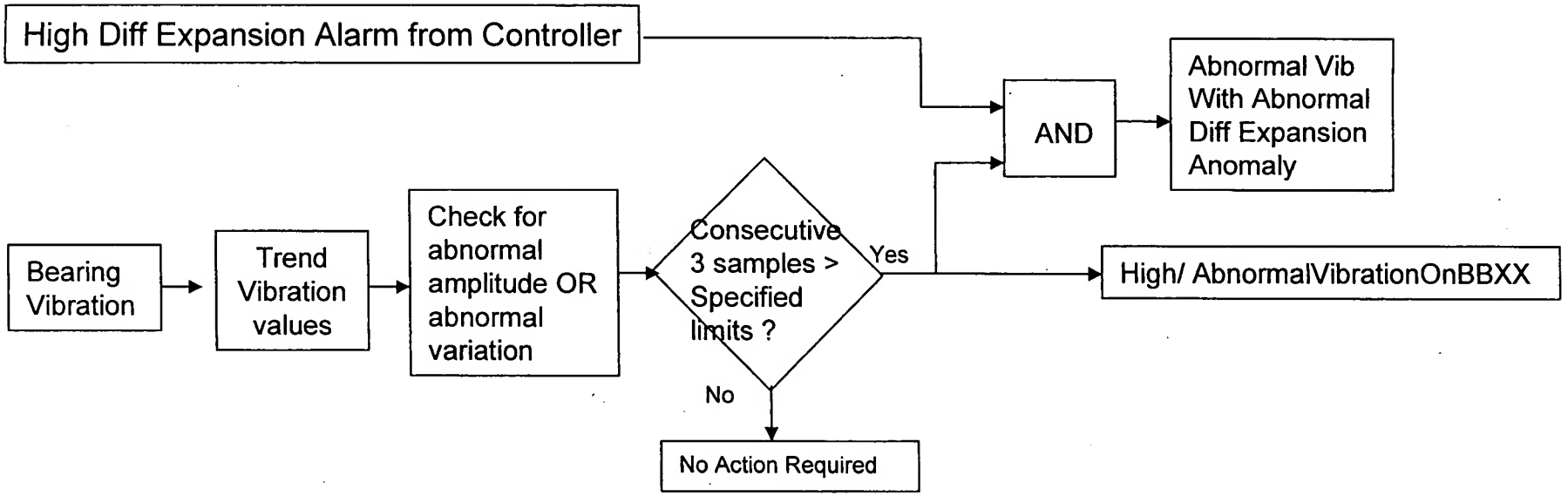


EXHIBIT A - 3/5

8.6.61 High eccentricity following vibration excursion.

Priority: H

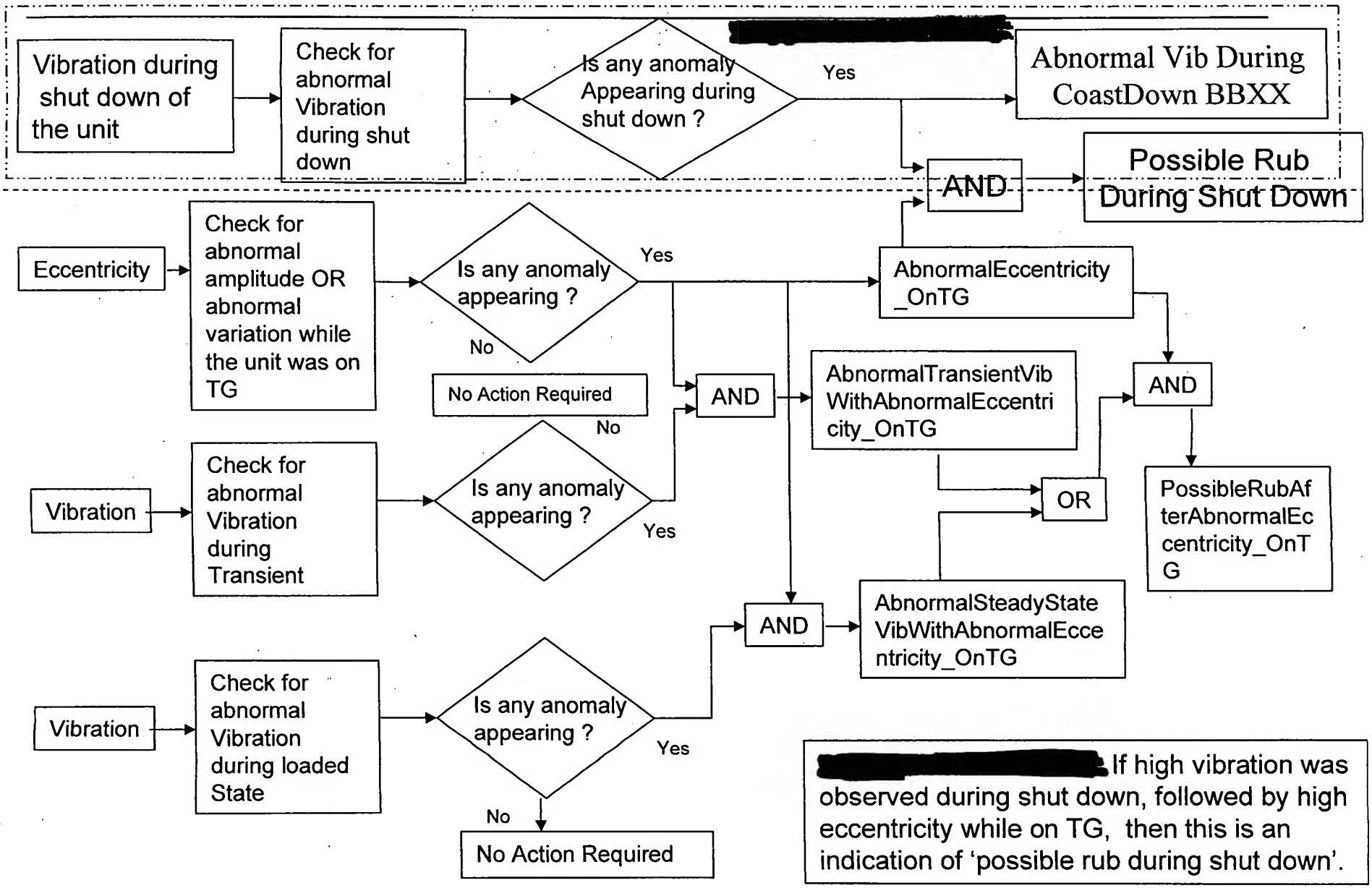
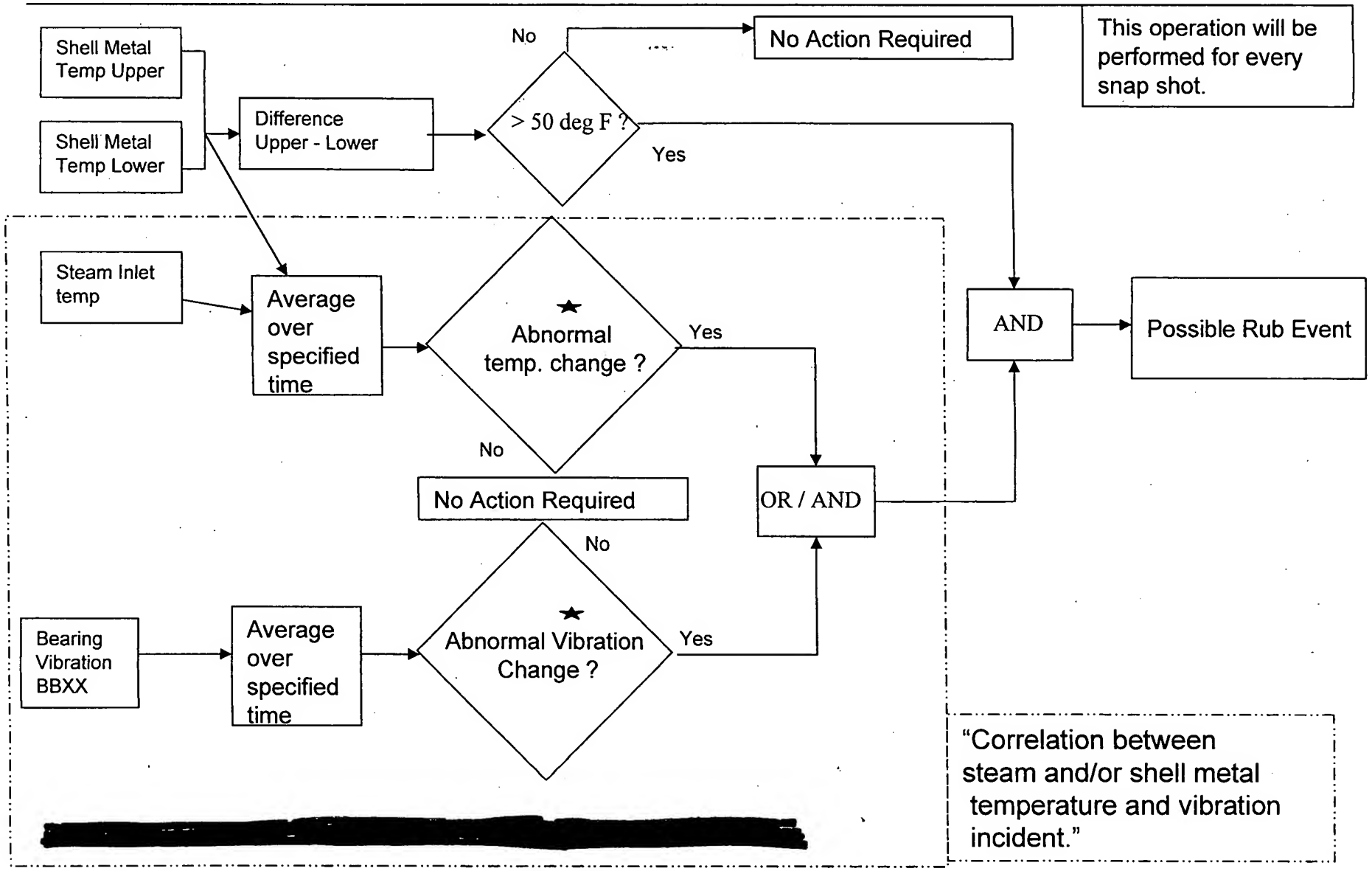


EXHIBIT A - 4/5

8.6.77 Sudden large shell temperature ramp

Priority: HH



★ Abnormal change is defined as: '*Larger than specified*' change in amplitude over specified time period (10 seconds) OR amplitude exceedence over specified limits.

EXHIBIT A - 5/5

Rub Anomaly Flow Down

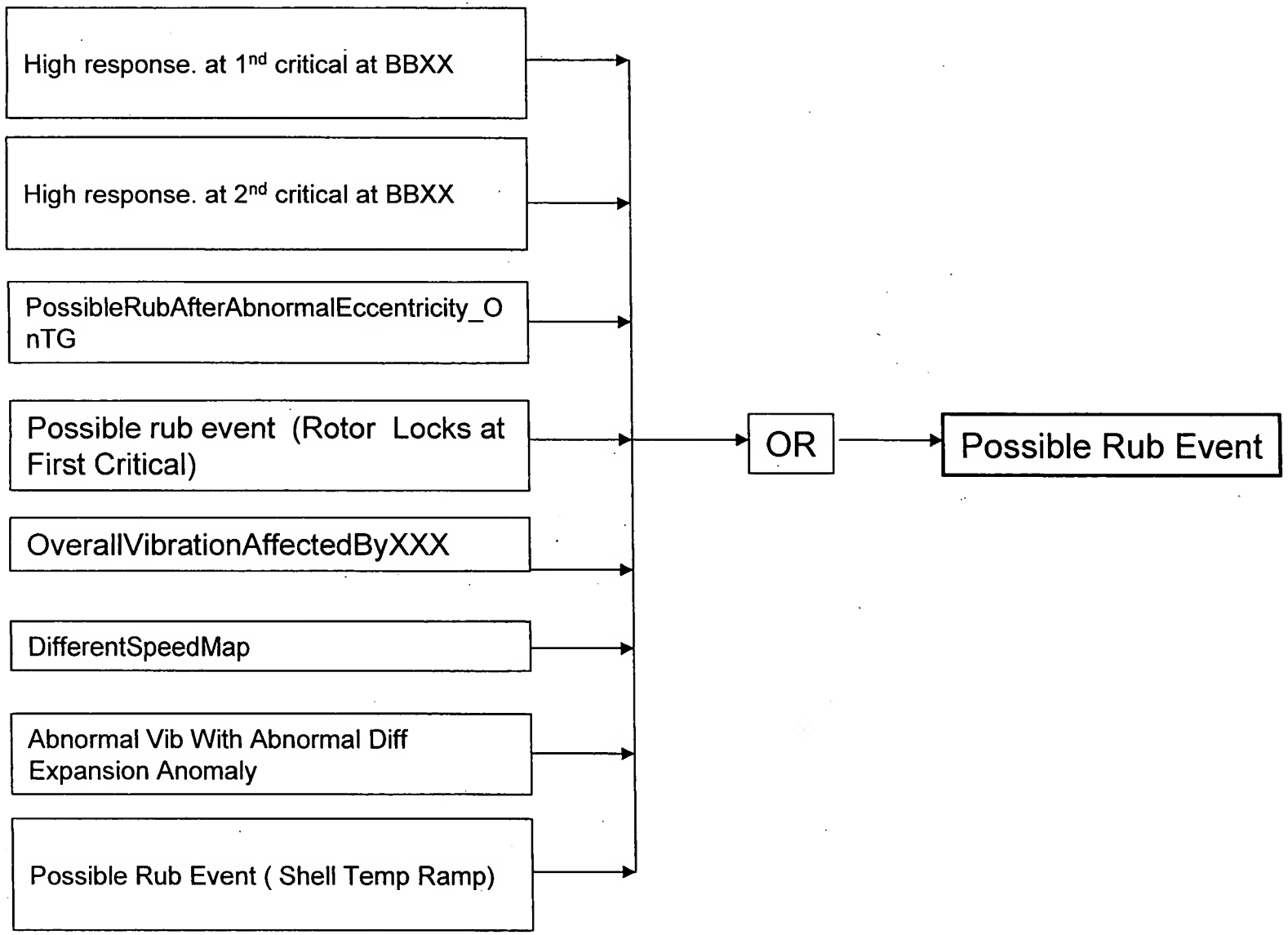


EXHIBIT B - 1/1

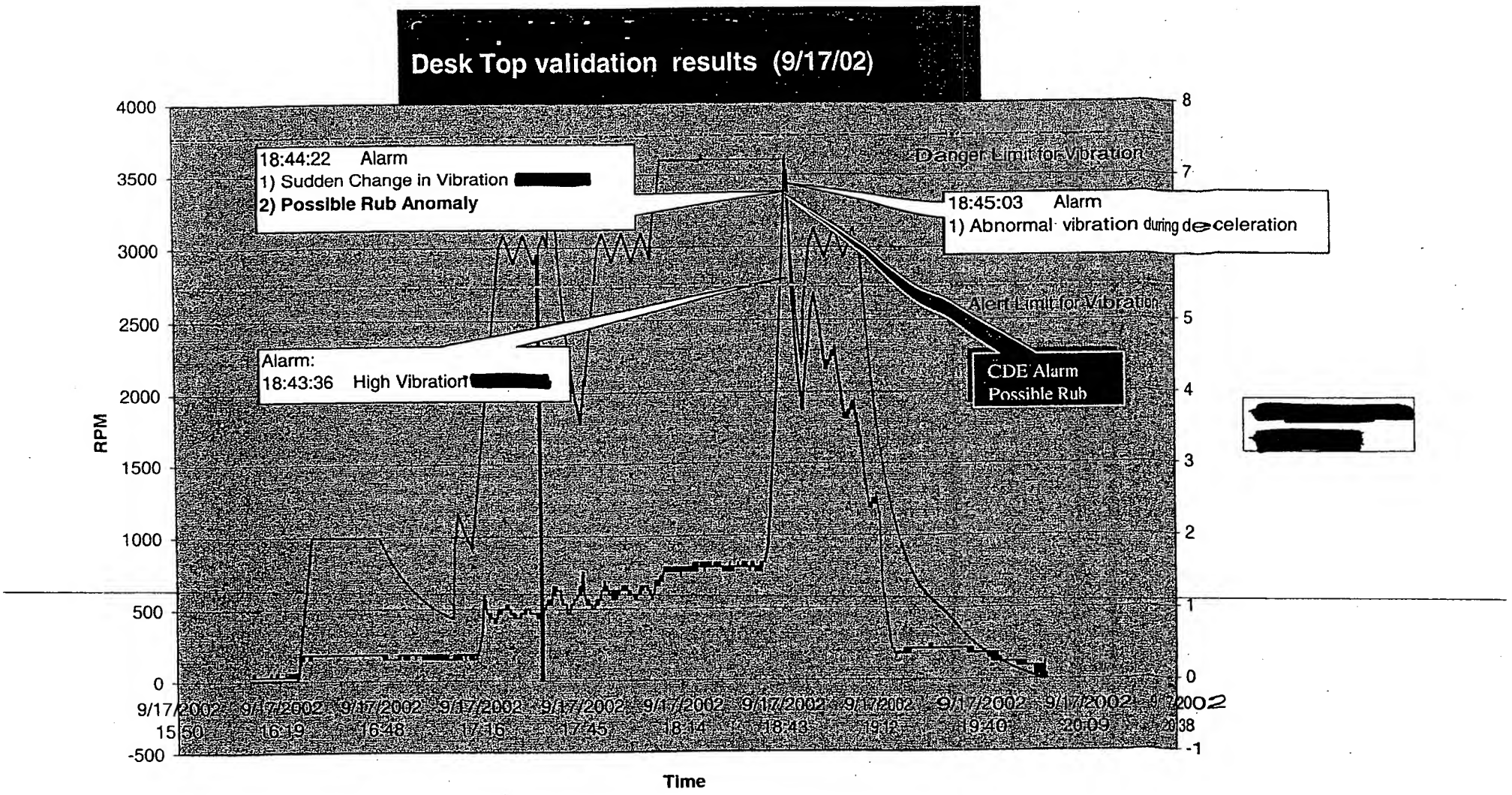

Desk Top validation results (9/17/02)
18:44:22 Alarm
1) Sudden Change in Vibration [redacted]
2) Possible Rub Anomaly
18:45:03 Alarm
1) Abnormal vibration during deceleration
Danger Limit for Vibration
Alert Limit for Vibration
Alarm:
18:43:36 High Vibration [redacted]
CDE Alarm
Possible Rub
[redacted]
RPM
4000
3500
3000
2500
2000
1500
1000
500
0
-500
8
7
5
4
3
2
1
0
-1
9/17/2002 15:50
9/17/2002 16:19
9/17/2002 16:48
9/17/2002 17:16
9/17/2002 17:45
9/17/2002 18:14
9/17/2002 18:43
9/17/2002 19:12
9/17/2002 19:40
9/17/2002 20:09
9/17/2002 20:38
Time

EXHIBIT C - 1/15

Steam Turbine Remote Monitoring & Diagnostics

Rub Detection CDE Application
Design Review

December 18, 2002

Abhay Kant

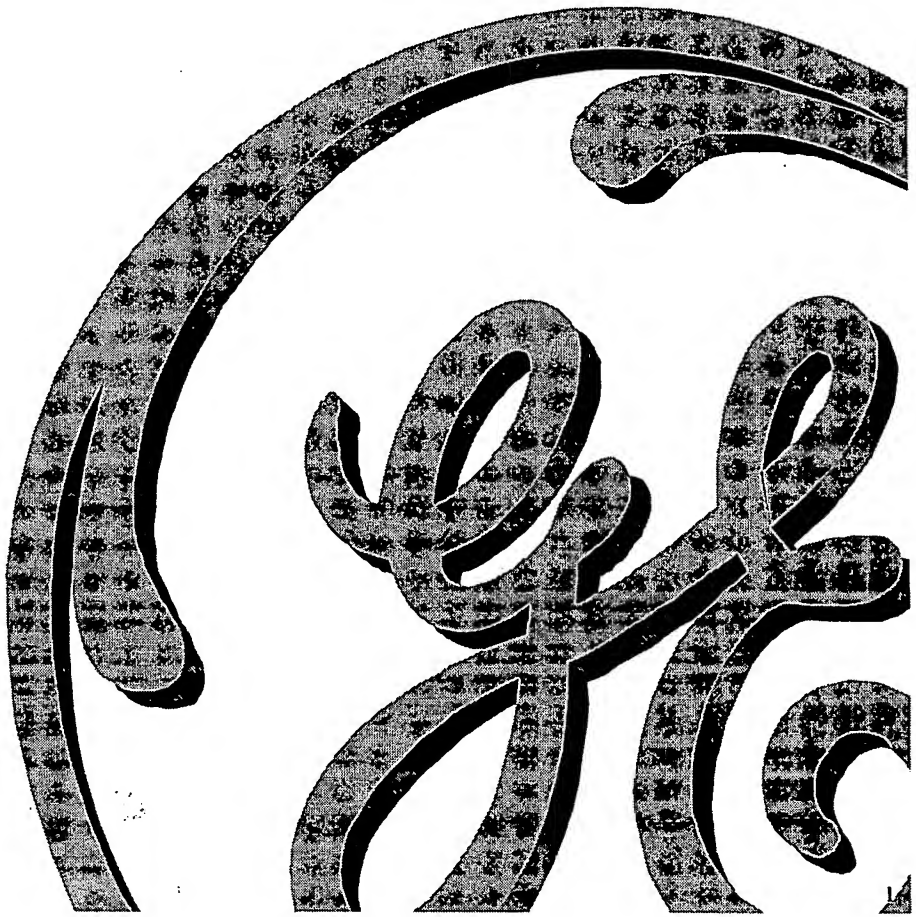


EXHIBIT C - 2/15

ST Rub CDE Design Review - Agenda

1. Executive Summary
2. Algorithm design
3. Testing and validation
4. Commissioning Process
5. Monitoring and alarm escalation process
6. Future development of CDE
7. Conclusions
8. Discussions

EXHIBIT C - 3/15

ST Rub CDE Design Review

What is a CDE? Why a CDE?

- Continuous Data Engine (CDE) is a real-time anomaly detection platform, that resides on the On-Site Monitor (OSM).
- A CDE allows real time monitoring of events or anomalies in the turbine
- Significant reduction in data processing load compared to manual monitoring

Already existing CDE Applications:

- Gas Turbines Condition Monitoring System (VPO Module)
- Gas Turbine Trip Detection

Why CDEs for Steam Turbines?

- Real time events such as Rubs or Trips are best detected locally in the OSM in real-time
- Allows quick escalation of such critical events to response teams in various organizations (Op Center, Product Services, Steam Turbine Technology)

Why 'Rub Detection CDE' for Steam Turbines?

- Rub is a key major contributor to ST performance degradation
- Rub detection across the monitored fleet provides data for a more efficient RCA process for ST problems
- Detection is the precursor to prediction and ultimately rub minimization

[redacted]

EXHIBIT C - 4/15

Generic CDE Data Flow - Overview

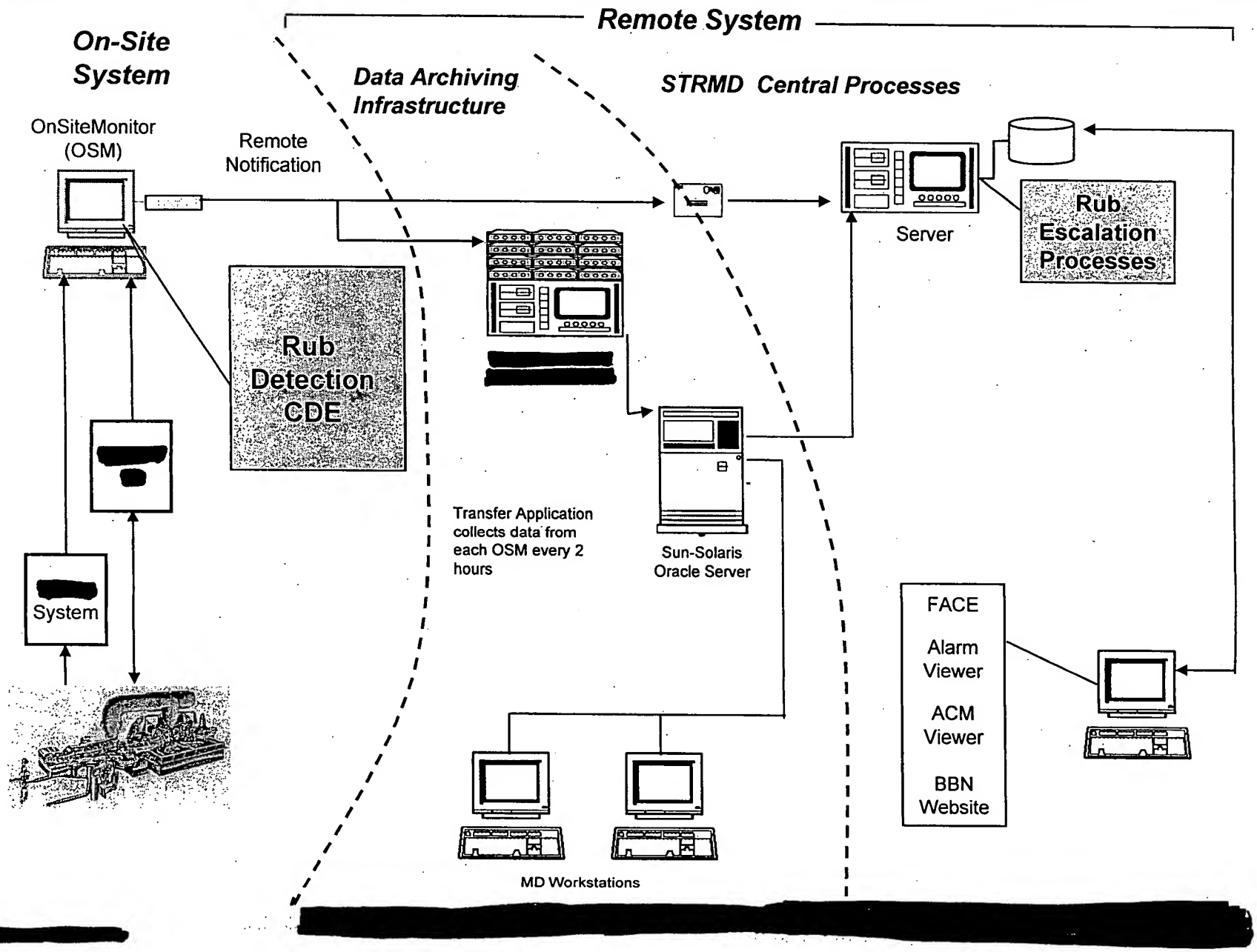
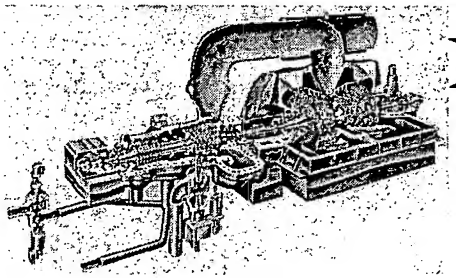


EXHIBIT C - 5/15

High level Representation of alarm flow

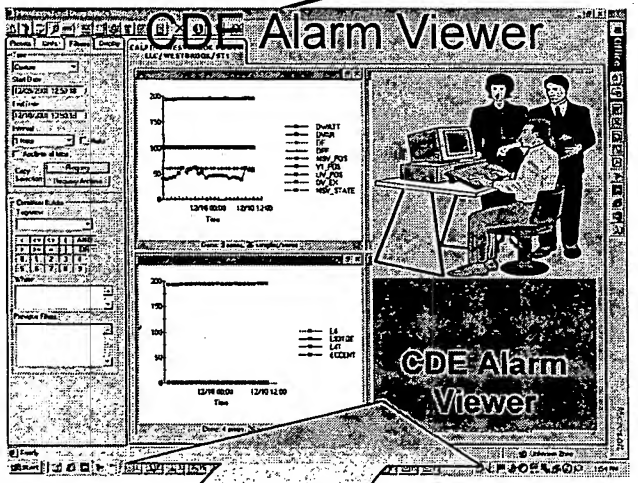


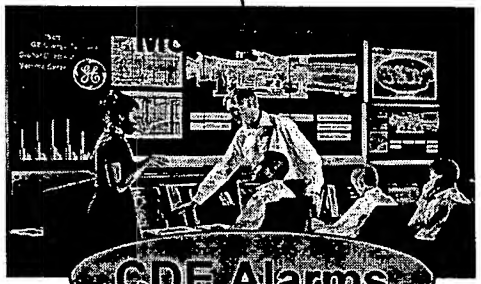
Inputs

Alarms

OSM

E mail Notifications





Yellow

Red

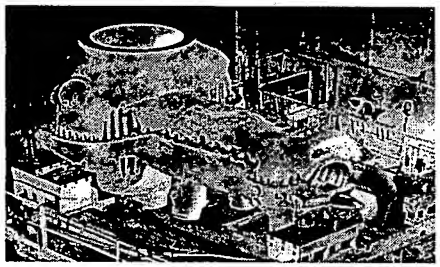
Log information

Escalate

Filtered, Prioritized alarms are escalated to experts.

EXHIBIT C - 6/15

Alarm grouping (hierarchy of alarms)



No. Of Inputs: 22

Input 1 | Input 2 | Input 3 | Input 4 | Input 5 | - - - - | Input n

No. of Alarms: 160

Sudden change | High vibration | Abnormal Temp/ ECCENT | Sudden change | High vibration | Abnormal Temp

Alarm 24

Group 1 | Group 2 | Group 4 | Group 5 | Group 6 | Group 8

24 BIT Index

No of Groups: 8

Transient Group Alarms

Steady State Group Alarms

Rub Algorithm 1 | Rub Algorithm 2 | Rub Algorithm 3 | Rub Algorithm 10

Rub Alarms

Diagnostic Group Alarms

No. of Rub Algorithms: 10

EXHIBIT C - 7/15

Validation results for DT and OSM testing with real field data

S.No	For unit	Model	For time period	Alarm Type	Opportunities	Defects	DPMO
1	270T490 [redacted] North America,	D11	7/9/2002 7.40 to 8.40 am	Missed	1800	0	0
				False Alarms	1800	0	0
2	270T474 [redacted]	A10	6/26/2002 10.45 to 12 pm	Missed	2200	0	0
				False Alarms	2200	0	0
3	270T476 [redacted]	A10	6/13/2002 9.30 to 11.10 am	Missed	2200	0	0
				False Alarms	2200	0	0
4	270T478 [redacted]	D11	5/8/2002 2.20 to 5.00 pm	Missed	4500	0	0
				False Alarms	4500	0	0
5	270T471 [redacted]	D11	7/13/2002 19.10 to 23.30 Hrs	Missed	7800	0	0
				False Alarms	780	0	0
6	270T425 [redacted]	D11	6/8/2002 13.26 to 14.45 hrs	Missed	2400	0	0
				False Alarms	2400	0	0
7	270T483 [redacted]	D11	6/24/2002 11 to 11.30	Missed	900	0	0
				False Alarms	900	0	0
8	270T489 [redacted]	D11	5/31/2002 7.50 to 8.30 hrs	Missed	1200	0	0
				False Alarms	1200	0	0
9	270T434 [redacted]	D11	11/9/2002 7am to 11 am	Missed	7200	0	0
				False Alarms	7200	0	0
10	270T508 [redacted]	D11	9/17/2002 14 to 20 pm	Missed	9000	0	0
				False Alarms	9000	0	0
11	Synthetic case		4 hrs run	Missed	7200	0	0
				False Alarms	7200	1	139
12	270T465 [redacted]	A10	5/21/2002 5.20 to 7.40 am	Missed	4200	0	0
				False Alarms	4200	0	0
			Total Score	**Missed**	**47090**	**0**	**0**
				False Alarms	**47090**	**1**	**21**

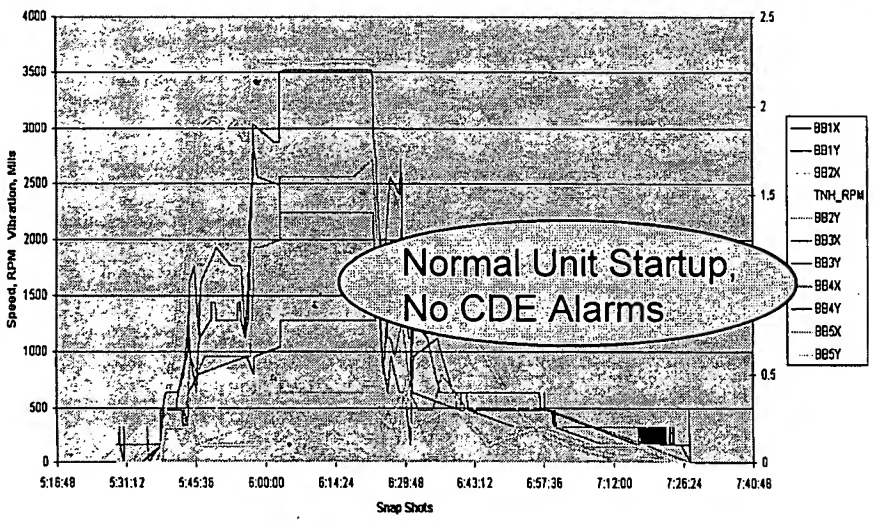
[redacted]

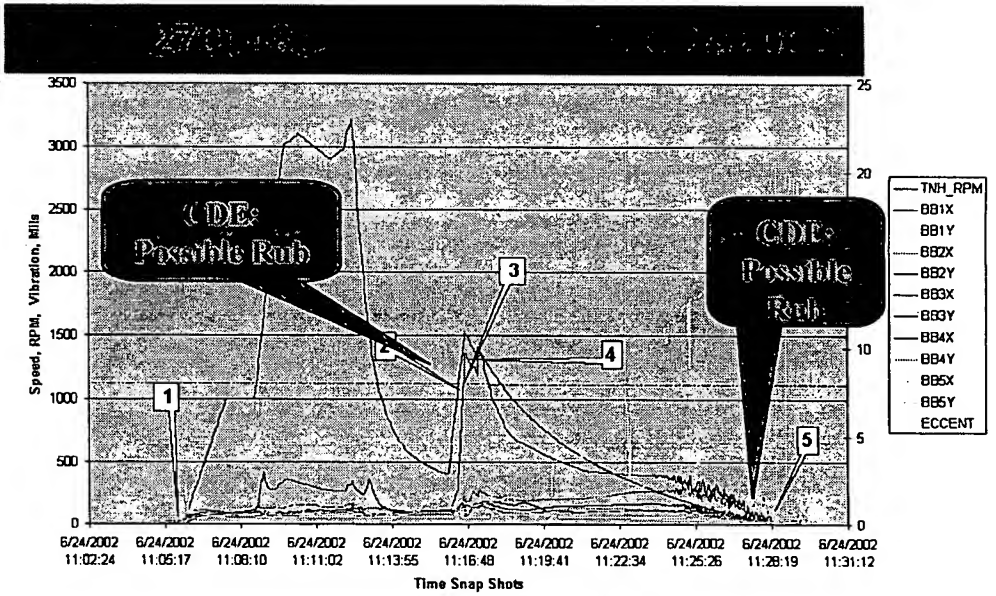
EXHIBIT C - 8/15

OSM Validation Results of CDE algorithms with '*Real Rub Event*' Data

Overview

270T465 Field data (5/21/2002) - Normal





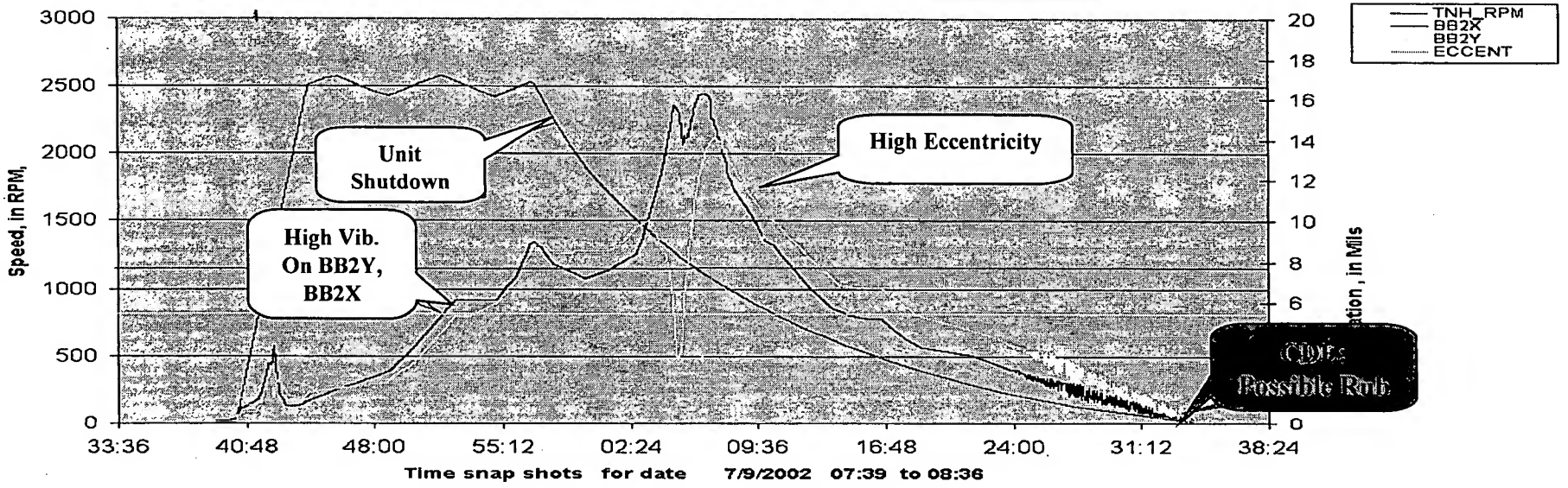
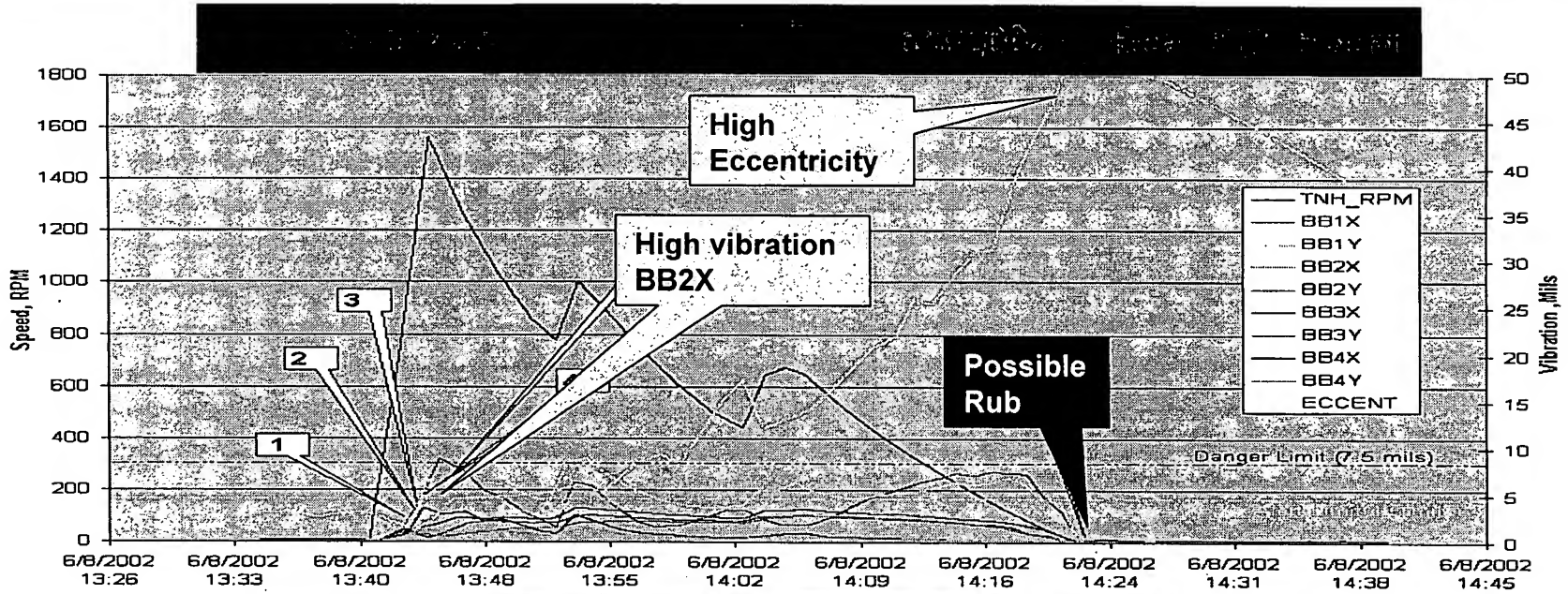


EXHIBIT C - 9/15

OSM Validation of CDE algorithms with '*Real Rub Event*' Data



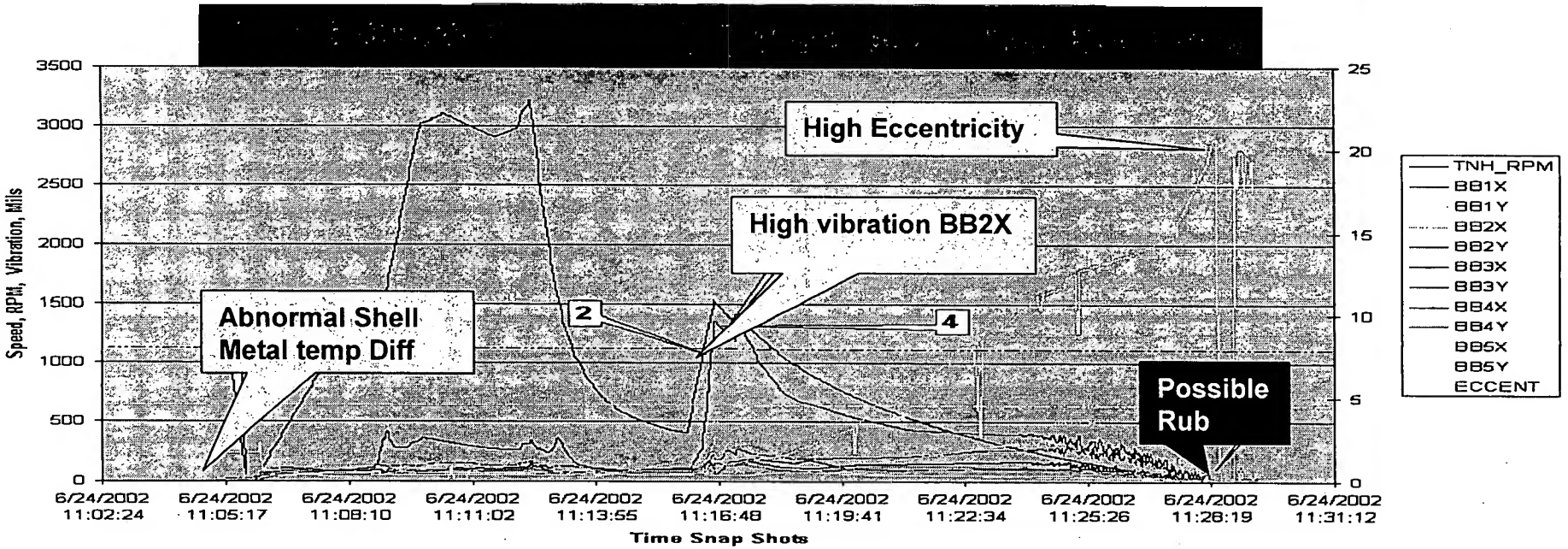


EXHIBIT C - 10/15

Field Deployment Results of CDF beta test

	Total	[redacted] 270T434	270T483	270T489	270T471	270T508	[redacted]
Date of Installation		21-Nov-02	21-Nov-02	20-Nov-02	3-Dec-02	14-Sep-02	
Number of Transient events witnessed							
S/D	38	11	3	1	3	20	
S/U	39	10	4	1	3	21	
Weeks of Operation	22	3	3	3	2	11	
Total Opportunity	7171200	950400	950400	993600	388800	3888000	
Missed Alarms	0	0	0	0	0	0	0
False Alarms	2	2	0	0	0	0	0.28

Data up to December, 12, 2002

False Alarms
Zst: 6.0

CTQ for False Alarms: 0.1alarm/turbine/week (1 alarm/10 weeks)

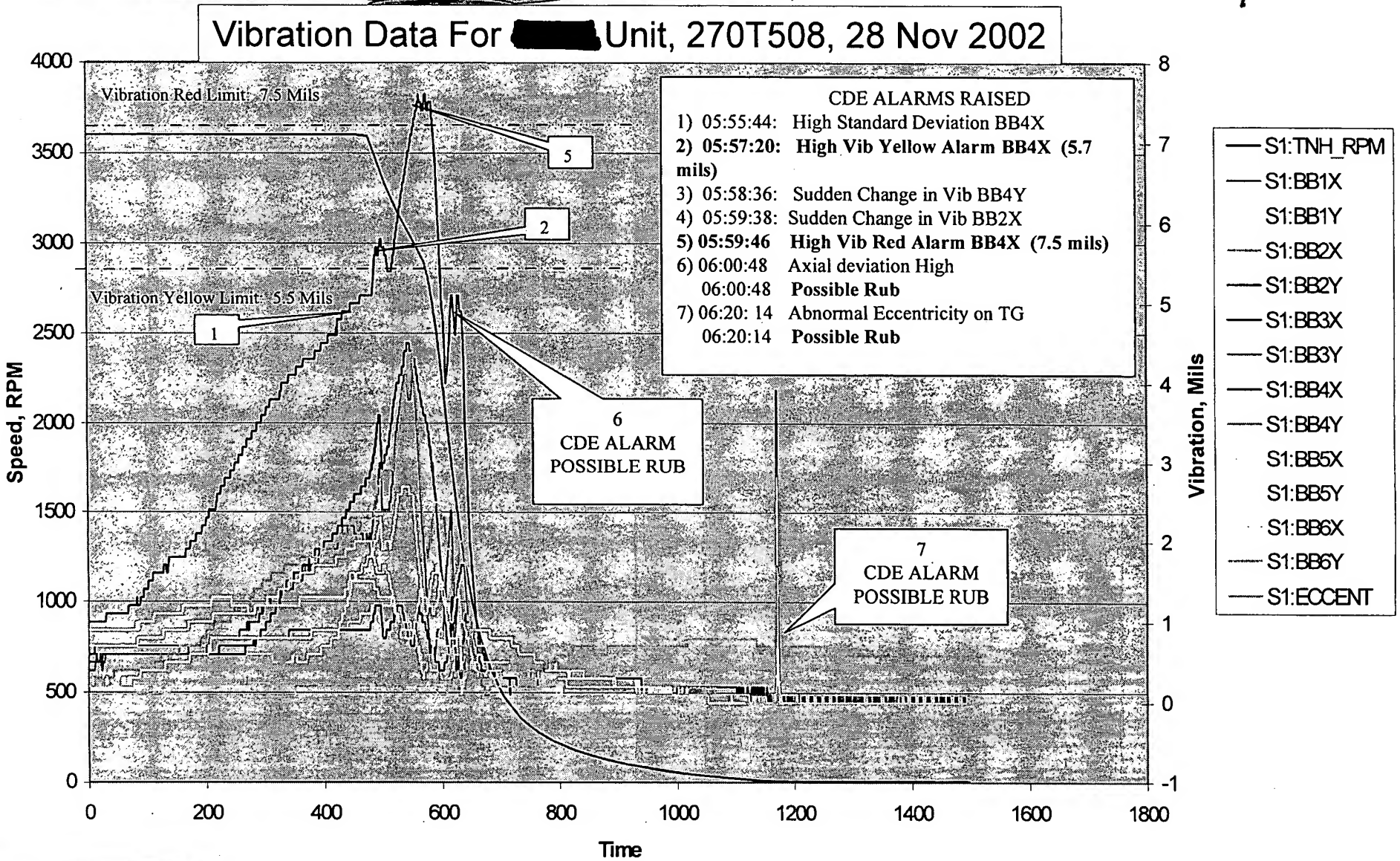
Actual: 2 Alarm in 22 Weeks. (0.9 alarms/10 week).

[redacted]

EXHIBIT C - 11/15

Field Deployment Results of CDE beta test

Real Vibration Event ...validated by experts



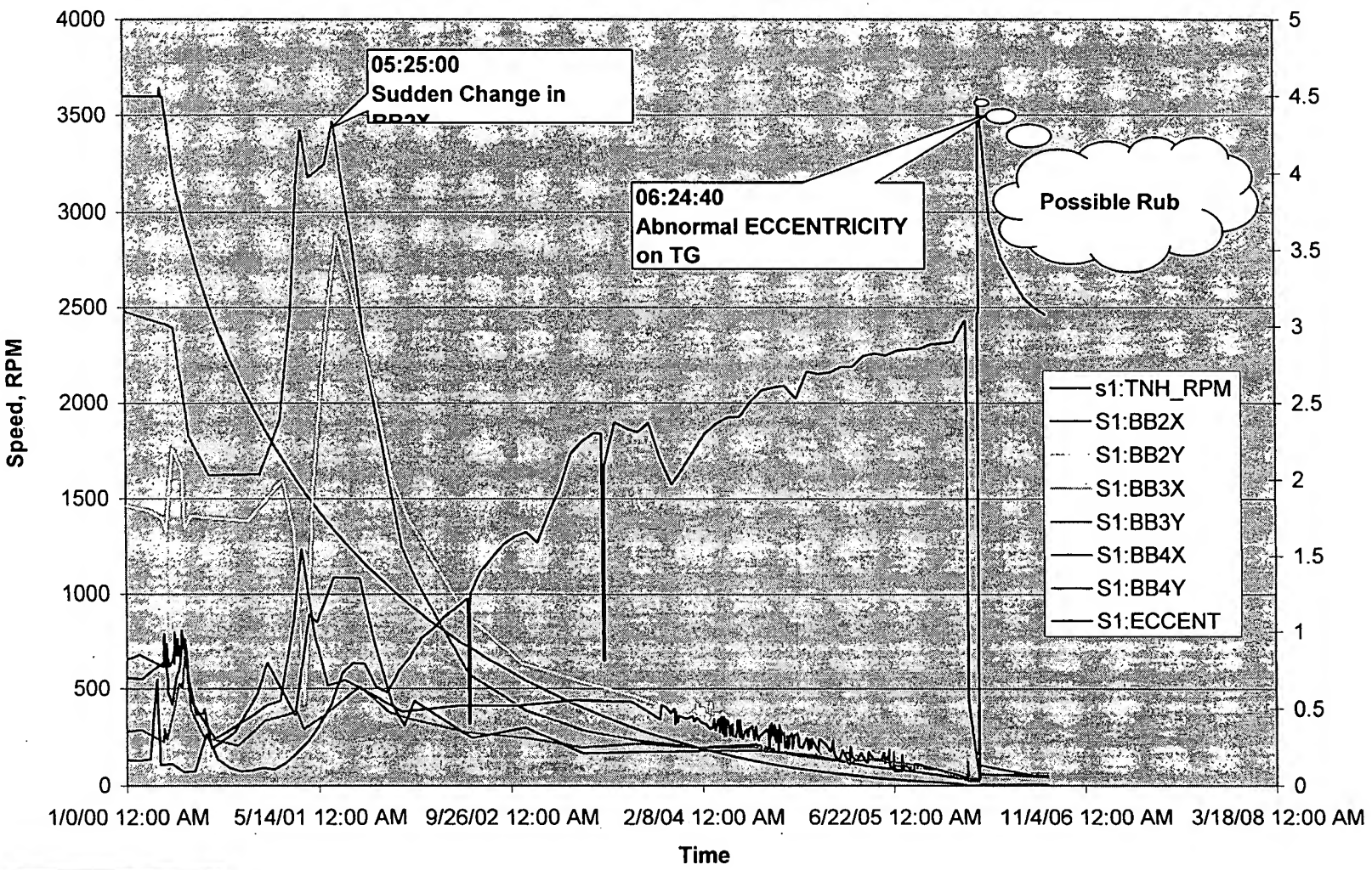
[redacted]

EXHIBIT C - 12/15

Field Deployment Results of CDE beta test

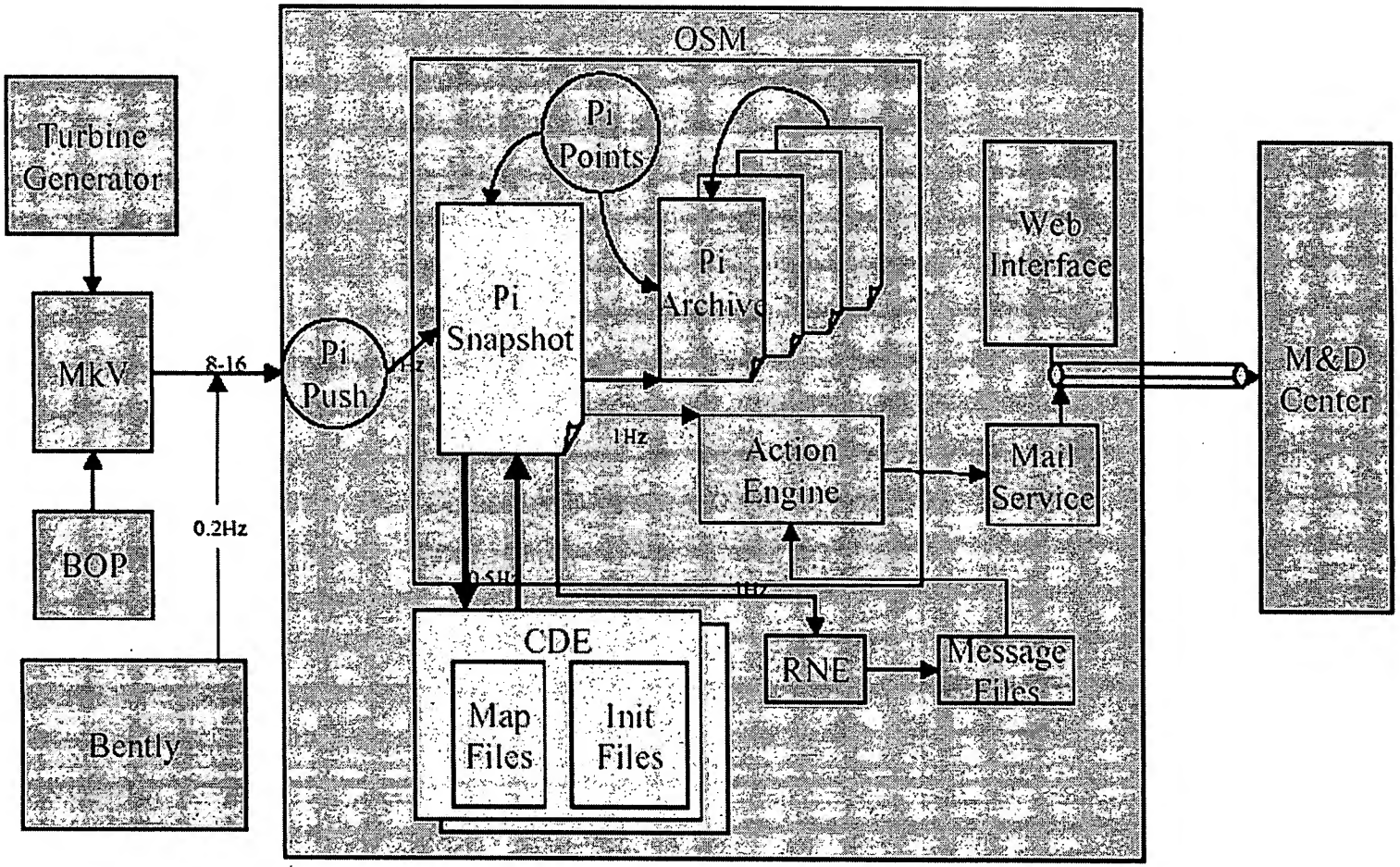
Real Vibration Event ...validated by experts

270T489 [redacted] 12/06/2002 05:10:00



[redacted]

OSM Data Flow Diagram

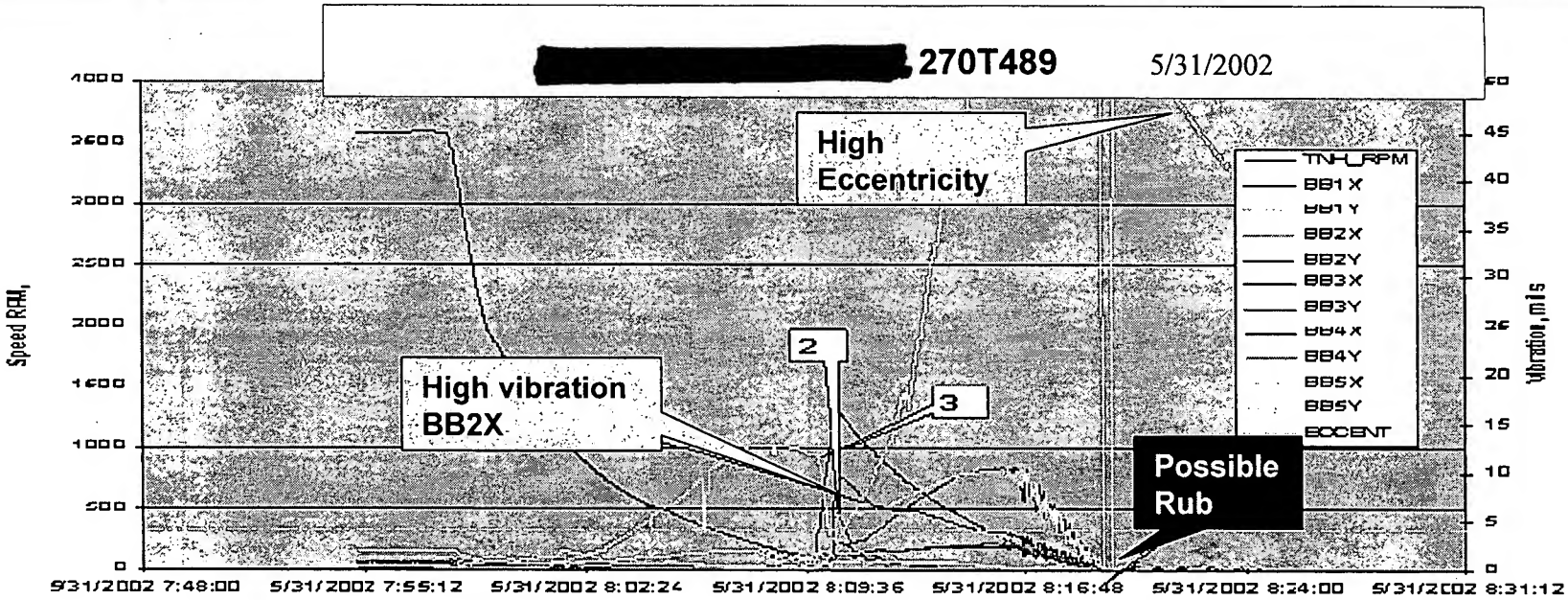


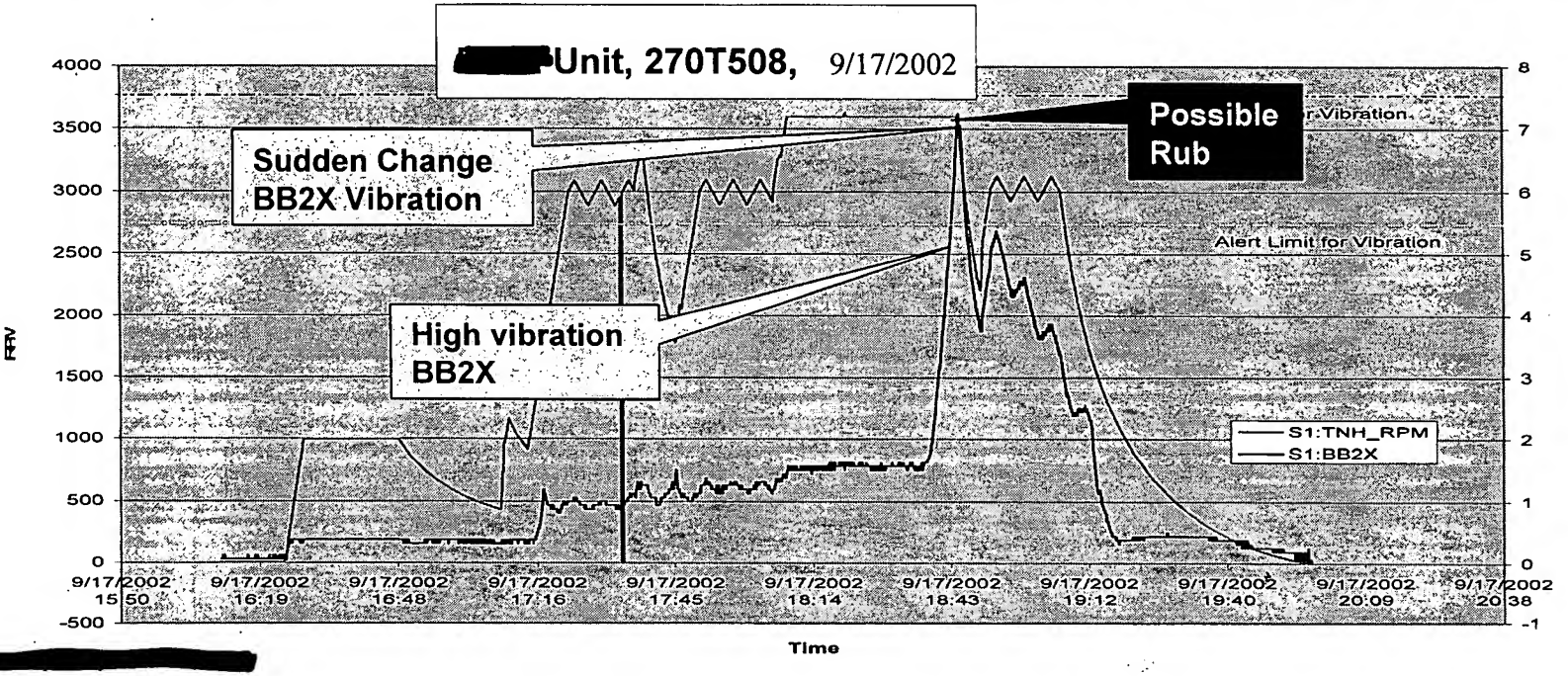
([redacted] *Design Review*, Nov 13, 2000, [redacted])

[redacted]

EXHIBIT C - 14/15

DT Validation of CDE with [redacted] unit data, 270T489



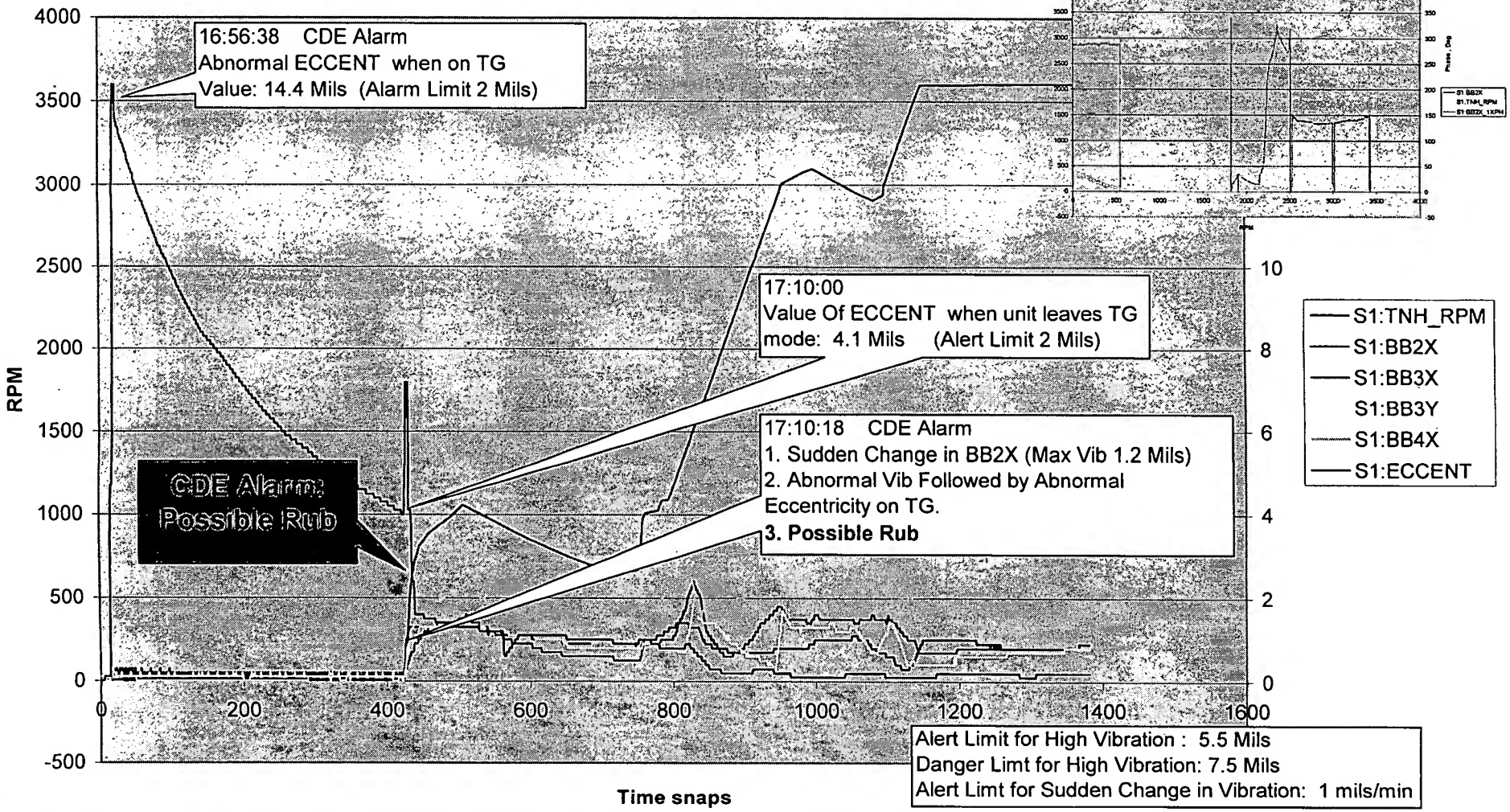


[redacted]

EXHIBIT C - 15/15

Field Deployment Results of CDE beta test

CDE Alarms for [redacted] Unit (270T508) Start up on 11/14/2002



[redacted]